

(19) World Intellectual Property Organization
International Bureau



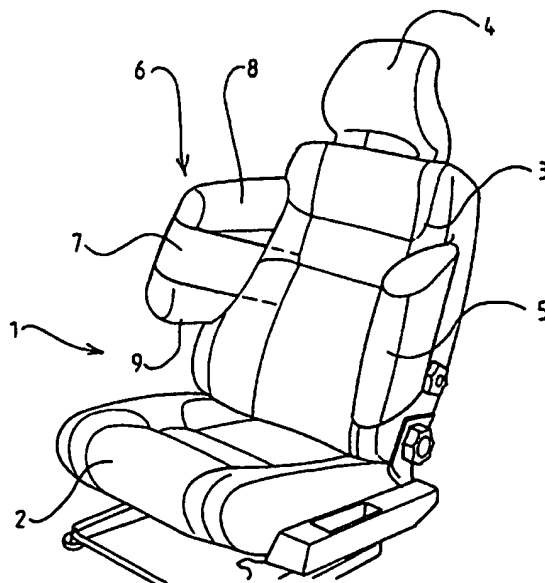
(43) International Publication Date
12 July 2001 (12.07.2001)

PCT

(10) International Publication Number
WO 01/49535 A1

- (51) International Patent Classification⁷: B60R 21/22, B60N 2/42
- (72) Inventor; and
(75) Inventor/Applicant (for US only): PILHALL, Stig [SE/SE]; Skillnadsgatan 46, S-461 53 Trollhättan (SE).
- (21) International Application Number: PCT/SE01/00004
- (22) International Filing Date: 4 January 2001 (04.01.2001)
- (74) Agent: MEULLER, Erik; Autoliv Development AB, S-447 83 Vårgårda (SE).
- (25) Filing Language: English
- (26) Publication Language: English
- (81) Designated States (national): DE, JP, US.
- (30) Priority Data: 0000094.3 5 January 2000 (05.01.2000) GB
- Published:
— With international search report.
- (71) Applicant (for all designated States except US): AUTOLIV DEVELOPMENT AB [SE/SE]; S-447 83 Vårgårda (SE).
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: AN AIR-BAG ARRANGEMENT



(57) Abstract: An air-bag (6) is provided mounted on that side edge (3) of a vehicle seat (1) which is remote from the adjacent door or side of the vehicle. The air-bag (6) when inflated extends forwardly of the side edge of the vehicle seat. A strap or stay (7) is provided having one end connected to the forward edge of the air-bag (8) and also connected part of the structure of the vehicle seat spaced towards the centre of the seat back relative to that part of the seat back carrying the air-bag (8). The strap or stay (7) initially ensures that the air-bag (8) extends forwardly, but on subsequent inflation of the air-bag the strap or stay may be partially wrapped around an occupant of the seat to retain the occupant in position.



WO 01/49535 A1

“AN AIR-BAG ARRANGEMENT”

THE PRESENT INVENTION relates to an air-bag arrangement, and more particularly relates to an air-bag arrangement incorporated in a vehicle seat.

It has been proposed previously to provide an air-bag arrangement mounted on a vehicle seat, but, typically, such an air-bag arrangement has been adapted to provide an inflated air-bag between an occupant of the seat and the adjacent door or side of the vehicle in the event that an accident should occur.

Whilst such an air-bag arrangement may provide a desired degree of protection, even with such an air-bag arrangement there is a risk that in a side impact or roll-over situation where two adjacent seats in a motor vehicle are both occupied, the heads of the occupants of the seats may be brought together.

Thus the present invention seeks to provide an improved air-bag arrangement.

According to this invention there is provided an air-bag arrangement mounted in a vehicle seat and incorporating an air-bag adapted to be inflated, the air-bag arrangement being mounted within the structure of the vehicle seat at such a position that the air-bag, when inflated, will extend generally forwardly from a side part of the back-rest of the seat, the air-bag being

positioned on that side of the seat which is remote from the door or side of the vehicle. The air-bag arrangement is provided with a strap or stay, one end part of the strap or stay being secured to part of the air-bag and the other end of the strap or stay being connected to part of the structure of the vehicle seat.

Preferably the air-bag is located so that at least part of the air-bag is substantially aligned with the centre of gravity of the torso of the occupant of the seat.

Advantageously an inflatable chamber is mounted on the rest of the air-bag, the chamber extending upwardly from the air-bag when inflated.

Conveniently the chamber is supported by a strap, the strap being secured to part of the air-bag and to part of the chamber.

Preferably the air-bag is provided with at least one substantially U-shaped reinforcing element with bending rigidity, the at least one reinforcing element being attached to the air-bag.

Advantageously the reinforcing element is made of a plastic material.

Conveniently the reinforcing element is made of a metallic material.

Advantageously the air-bag is mounted on a side part of the back-rest of the seat and the strap or stay is secured to part of the structure of the back-rest of the seat which is towards the centre of the back-rest relative to the said part of the back-rest on which the air-bag is mounted. Thus the strap or stay, the air-bag and the region of the vehicle seat between them define a triangle when viewed from above when the air-bag is inflated.

Preferably the end of the strap or stay that is secured to the structure of the vehicle seat is connected to part of the structure of the vehicle seat located between two side frame elements that constitute the frame-work supporting the back-rest of the vehicle seat.

In one embodiment the said end of the strap is connected to a sprung panel-work forming the central part of the back-rest of the seat, the sprung panel-work being supported, by arms, on the side frame elements of the back-rest of the seat.

In an alternative embodiment the end of the strap is connected to a mounting element mounted on one of the side frame elements forming the back-rest of the seat.

Preferably the mounting element is pivotally mounted to the back-rest of the seat.

Conveniently the strap is bifurcated. the bifurcated end portions of the strap being secured to the air-bag, the non-bifurcated end of the strap being secured to the structure of the back-rest of the seat.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a vehicle seat provided with a conventional air-bag, and an air-bag in accordance with the present invention, with both of the air-bags being shown in the inflated state,

FIGURE 2 is a view corresponding to Figure 1 illustrating a modified embodiment of the invention, but with the conventional air-bag omitted,

FIGURE 3 is an enlarged view of the air-bag of Figure 2,

FIGURE 4 is a top horizontal sectional view through the back-rest of the seat of Figure 2, and

FIGURE 5 is a view corresponding to Figure 4 illustrating a modified embodiment of the invention.

FIGURE 6 is a view illustrating a modified embodiment of the invention with an inflatable chamber mounted on the air-bag.

FIGURE 7 is a simplified front view illustrating the embodiment of the invention described in Figure 6.

FIGURE 8 is a view illustrating a modified embodiment of the invention with two reinforced surfaces attached to the air-bag.

FIGURE 9 is a simplified front view illustrating the embodiment of the invention described in Figure 8.

The concept of the invention is that an air-bag is provided which is mounted in the back of a vehicle seat, and which is adapted to be inflated in the

event that an accident should occur, the air-bag being provided in that side of the vehicle seat which is adjacent the centre line of the vehicle. The air-bag, when inflated, extends generally forwardly and thus the air-bag constitutes a barrier between the occupant of the seat and the occupant of the next adjacent seat. In preferred embodiments the air-bag is provided with a stay which partially embraces the occupant of the seat to help retain the occupant of the seat in position.

Referring initially to Figure 1 of the accompanying drawings, a vehicle seat 1 is illustrated. The seat comprises a squab 2 and a back-rest 3, the back-rest 3 carrying a head-rest 4.

The seat 1 is provided with a first air-bag 5 which is initially stored within the back-rest 3 of the seat. The air-bag 5 is adapted to be inflated in the event that an accident, such as a side impact or roll-over accident, is detected. The inflated air-bag then extends generally forwardly from the side edge of the back-rest of the seat and provides a degree of protection for the occupant of the seat. At least part of the air-bag is aligned with the centre of gravity of the torso of the occupant of the seat. It is to be understood that the side air-bag 5 is located on that side of the seat which is adjacent the door or side of the vehicle in which the seat is mounted. As thus far described the seat and air-bag arrangement is conventional.

The seat 1 is provided with a second air-bag 6, which forms an air-bag in accordance with the invention. The air-bag 6 is initially stored within the back-rest of the seat, and is mounted on a side part of the back-rest. The air-bag 6 is adapted, on inflation, to extend generally forwardly from that side part of the back-rest 3 of the seat which is located adjacent the centre line of the vehicle. At least part of the air-bag is aligned with the centre of gravity of the

torso of the occupant of the seat. A strap or stay 7 is provided which is connected to that part of the air-bag which, when the air-bag is inflated, constitutes the forward most end of the air-bag. The stay is also connected to part of the structure of the seat, as will be described hereinafter in greater detail. The part of the structure to which the stay is connected is located towards the centre of the back-rest of the seat relative to the side part of the back-rest that carries the air-bag. The intention is that, as the air-bag inflates, the air-bag will initially extend forwardly and outwardly from the back-rest 3 of the vehicle seat. However, as the inflation process continues, the stay 7 will become tensioned, and the forward end of the air-bag 6 will then be drawn more inwardly. At this stage the air-bag, the stay and the part of the back-rest of the seat between the air-bag and the stay define a triangle, as viewed from above. As the air-bag 6 continues to inflate, so the stay 7 may be moved to a position in which it at least partially embraces an occupant of the seat to help maintain the occupant of the seat in position.

In the embodiment shown in Figure 1, the air-bag 6 may comprise an upper horizontally extending inflated chamber 8 and a lower horizontally extending inflated chamber 9. The region between the chambers 8 and 9 may be a non-inflated region, or may constitute a further intermediate horizontally extending chamber.

Figures 2 and 4 illustrates a modified embodiment of the invention. In this embodiment of the invention an air-bag 10 is provided which comprises a single rectangular chamber provided with a centrally located horizontal seam 11 (see Figure 3). The air-bag is mounted at a position which is equivalent to the position of the air-bag as described above. Thus the air-bag is provided on the side of the seat that is remote from the door on the side of the vehicle.

The seam 11 may be considered to divide the chamber of the air-bag 10 into two horizontally extending parallel cells 12, 13.

A strap or stay 14 is provided. The strap or stay presents a first end 15 which, as will be described hereinafter, is connected to part of the back-rest 3 of the seat. The other end of the stay is bifurcated forming two relatively thin strap portions 16, 17. The strap portion 16 is connected to the part of the air-bag 10 that will constitute the forward-most end of the cell 12 and the strap portion 17 is connected to that part of the air-bag 10 that will form the forward-most end of the cell 13.

Figure 4 illustrates the back-rest 3 of the vehicle seat in section, whilst also showing the squab 2 of the vehicle seat.

The back-rest 3 of the vehicle seat incorporates a frame, on which the remaining components of the seat are directly or indirectly mounted. A first vertical frame member 20 is provided on the left-hand side of the seat-frame and a second frame member 21 is provided on the right-hand side of the seat-frame. Mounted between the frame members 20, 21 is a conventional sprung panel 22 known as a "pullmaflex" panel. The panel 22 is supported by a plurality of horizontally extending metal arms 23, 24. The arm 23 has one end pivotally connected to the frame member 20 and has the other end engaging, in a hook-like manner, one edge of the panel 22. Similarly the arm 24 is pivotally connected, at one end, to the frame member 21, and has the other end engaging, in a hook-like manner, the opposite side of the panel 22.

A biasing spring 25 is provided extending between the connection of the arm 23 and the panel 22, and a forward part of the frame element 20 of the

back-rest of the seat. This serves to bias the point of connection forwardly. Similarly, a further spring 26 is provided which extends between the point of connection between the arm 24 and the panel 22, and a forward part of the frame member 21.

Thus the sprung panel 22 is biased forwardly by the springs 25, 26 whilst being retained in position by the metal straps 23, 24. The entire structure is surrounded by appropriate padding and foam to constitute the back-rest 3 of the seat. As thus far described, the back-rest 3 is of conventional design.

At this stage it is to be noted that the frame member 21 carries the air-bag 10. A generally vertically extending gas generator 27 is provided which is mounted on the frame element 21. The gas generator is initially contained within a housing (not shown) which contains the air-bag 10 in a folded state, and also the greater proportion of the strap or stay 14. However, the end 15 of the strap or stay 14 is connected to the edge of the sprung panel 22 that is engaged by the metal strap 24.

Figure 4 illustrates the situation when the air-bag 10 has been inflated. Inflation occurs in response to a signal from an appropriate sensor which is responsive to a side impact or roll-over situation. As the air-bag begins to inflate it emerges from the side of the back-rest of the seat which is adjacent the centre line of the vehicle, and initially the air-bag moves outwardly generally laterally away from the seat. As the air-bag inflates the point where the forward ends of the strap portions 16, 17 move away from the point where the end region 15 of the strap is secured to the structure of the back-rest of the seat. The effect of this is that the end of the air-bag where the strap portions 16 and 17 are secured to the air-bag begins to move more forwardly of the vehicle.

Thus, as the air-bag inflates initially the air-bag moves generally outwardly, away from an occupant of the seat and with a component that extends laterally of the vehicle but then, under the influence of the strap 14, the forward end of the air-bag begins to move more forwardly of the vehicle, and finally moves generally inwardly, transversely across the seat, so that the strap 14 is brought to a position in which it partially embraces the occupant of the seat. At least part of the air-bag is aligned with the centre of gravity of the occupant of the seat.

The air-bag 10, when inflated, thus provides a physical barrier between the occupant of the seat and the occupant of the next adjacent seat, thus minimising any risk that the heads of the occupants of the seats will engage each other. Also, the combination of the air-bag and the strap help retain the seat occupant in position during a side impact or roll-over situation.

Figure 5 illustrates a modified embodiment of the invention in which the end 15 of the strap is not connected to a resiliently biased panel that forms part of the back of the seat but, instead, is connected to an anchoring point 30 present on an anchor plate 31 which is secured to the frame element 21 that forms the structure of the back of the seat. In the described embodiment the anchor plate 31 is connected to the frame member 21 by means of a pivotal connection 32 to enable the plate element 31 to move rearwardly to the position 33 as shown in dotted lines. The plate element may thus move forwardly and rearwardly within the seat back as the padding of the seat moves when the seat is occupied. Thus the plate element will not be noticeable to an occupant of the seat.

Figures 6 and 7 illustrate a modified embodiment of the invention in which an inflatable chamber 40 is mounted to the upper portion of the air-bag

10. The upper portion of the chamber 40 is secured to the air-bag 10 by a strap 41. The strap 41 is connected by seams or adhesive means to the chamber 40 at one end and to the airbag 10 at the other end. The chamber 40 is provided with a substantially circular cell 42 in the lower part of the chamber 40 thereby creating gas inlet apertures 43, 44 between the cell 42 and the wall of the air-bag 10. The shape of the arrangement with the cell 42 and the apertures 43, 44 stabilises the chamber 40, thereby helping the chamber 40 to "stand up", when inflated. During inflation of the air-bag 10 gas from the air-bag 10 will pass through the inlet apertures 43, 44 and inflate the chamber 40. The chamber 40 will protect the head of an occupant in case of a side impact or a roll-over situation. The strap 41 may be mounted on the side of the air-bag 10 not facing the occupant of the seat in inflated condition, but it is preferred to mount the strap 41 on the side of the air-bag 10 facing the occupant in inflated condition. The strap 41 will in the preferred embodiment hold the chamber 40 inwardly close to the occupant head for best protection when inflated.

Figures 8 and 9 illustrate another modified embodiment of the invention in which a reinforcing element 50 is attached to the outer surface of the air-bag. The reinforced element 50 comprises two sheets 51, 52 of flexible material. The sheets 51, 52 may be attached to the air-bag 10 by adhesive means or/and may be mounted to the seat frame 21 at one end. The sheets 51, 52 have U-shaped profiles. Such a profile has bending rigidity that allows the sheets 51, 52 and the air-bag 10 keeping a protecting shape even when subjected to forces. Therefore the U-shaped sheets 51, 52 provide the air-bag 10 with preferred strength and stability in inflated condition. It is preferred to attach the sheets 51, 52 to the side of the air-bag 10 facing the occupant in inflated condition, but the sheets 51, 52 may be attached to the side of the air-bag 10 not facing the occupant in inflated condition. The flexible material in the sheets 51, 52 are plastic, rubber, metal or any other flexible material. Since the material is

flexible the sheets 51, 52 may be rolled or folded with the air-bag 10 for storage. When rolled or folded the flexible material will become substantially flat but when the air-bag 10 inflates the flexible material will regain its U-shaped profile. The reinforcing element 50 may consist of one or more sheets of flexible material. There might also be more than one reinforcing element 50.

It is to be noted that the strap 7 of the embodiment described in Figure 1 will be connected to the back of the seat in a manner equivalent to that described with reference to the strap 14 of Figures 2 to 4, or Figure 5.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

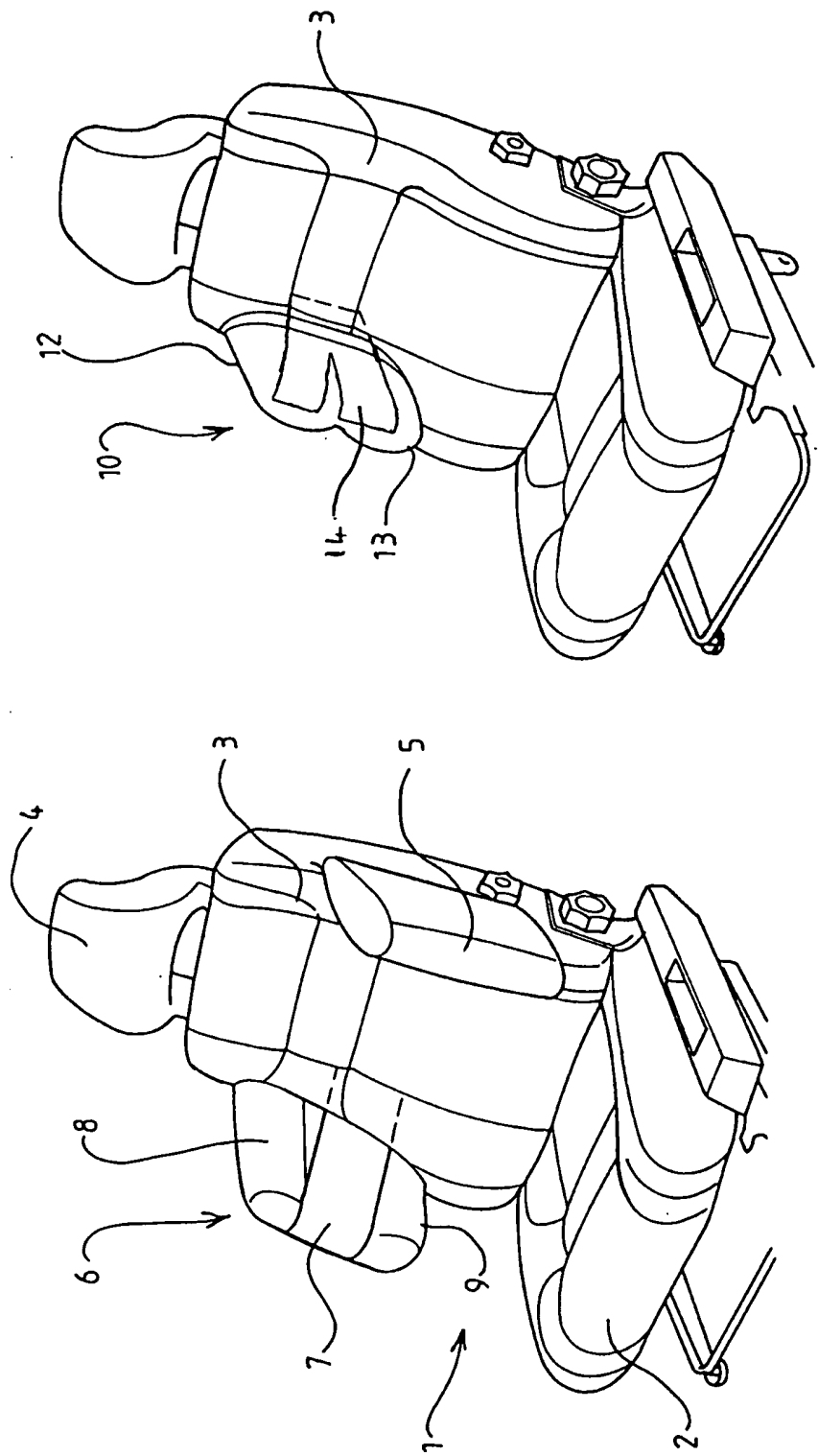
The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. An air-bag arrangement mounted in a vehicle seat and incorporating an air-bag adapted to be inflated, the air-bag arrangement being mounted within the structure of the vehicle seat at such a position that the air-bag, when inflated, will extend generally forwardly from a side part of the back-rest of the seat, the air-bag being positioned on that side of the seat which is remote from the door or side of the vehicle, a strap or stay being provided, one end part of the strap or stay being secured to part of the air-bag and the other end of the strap or stay being connected to part of the structure of the vehicle seat.
2. An arrangement according to Claim 1 wherein the air-bag is located so that at least part of the air-bag is substantially aligned with the centre of gravity of the torso of the occupant of the seat.
3. An arrangement according to any preceding claim wherein an inflatable chamber is mounted on the rest of the air-bag, the chamber extending upwardly from the air-bag when inflated.
4. An arrangement according to Claim 3 wherein the chamber is supported by a strap, the strap being secured to part of the air-bag and to part of the chamber.
5. An arrangement according to any of the preceding claims wherein the air-bag is provided with at least one substantially U-shaped reinforcing element with bending rigidity, the at least one reinforcing element being attached to the air-bag.

6. An arrangement according to Claim 5 wherein the reinforcing element is made of a plastic material.
7. An arrangement according to Claim 5 wherein the reinforcing element is made of a metallic material.
8. An arrangement according to Claim 1 wherein the air-bag is mounted on a side part of the back-rest of the seat and the strap or stay is secured to part of the structure of the back-rest of the seat which is towards the centre of the back-rest relative to the said part of the back-rest on which the air-bag is mounted.
9. An arrangement according to Claim 1 or 8 wherein the end of the strap or stay that is secured to the structure of the vehicle seat is connected to part of the structure of the vehicle seat located between two side frame elements that constitute the frame-work supporting the back-rest of the vehicle seat.
10. An arrangement according to Claim 9 wherein the said end of the strap is connected to a sprung panel-work forming the central part of the back-rest of the seat, the sprung panel-work being supported, by arms, on the side frame elements of the back-rest of the seat.
11. An arrangement according to Claim 9 wherein the end of the strap is connected to a mounting element mounted on one of the side frame elements forming the back-rest of the seat.
12. An arrangement according to Claim 11 wherein the mounting element is pivotally mounted to the back-rest of the seat.

13. An arrangement according to any one of Claims 1 or 8 to 12 wherein the strap is bifurcated, the bifurcated end portions of the strap being secured to the air-bag, the non-bifurcated end of the strap being secured to the structure of the back-rest of the seat.



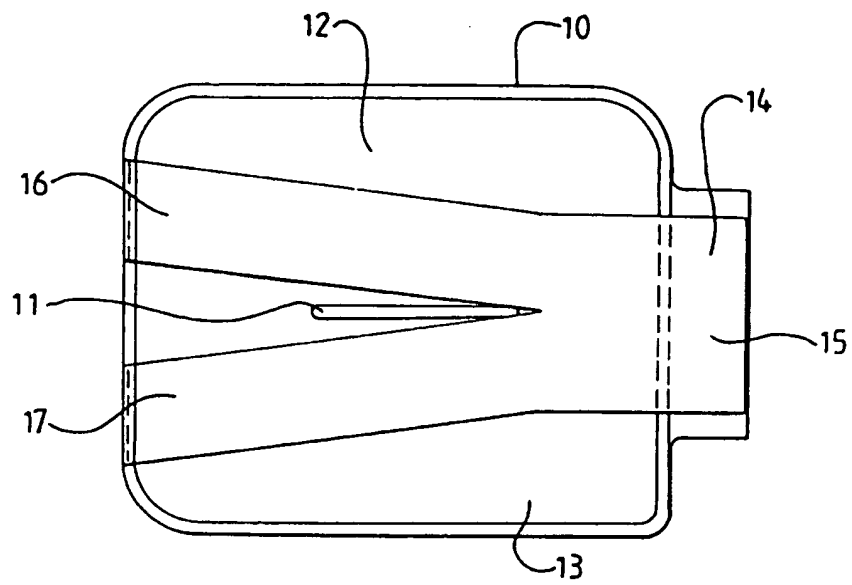


FIG 3

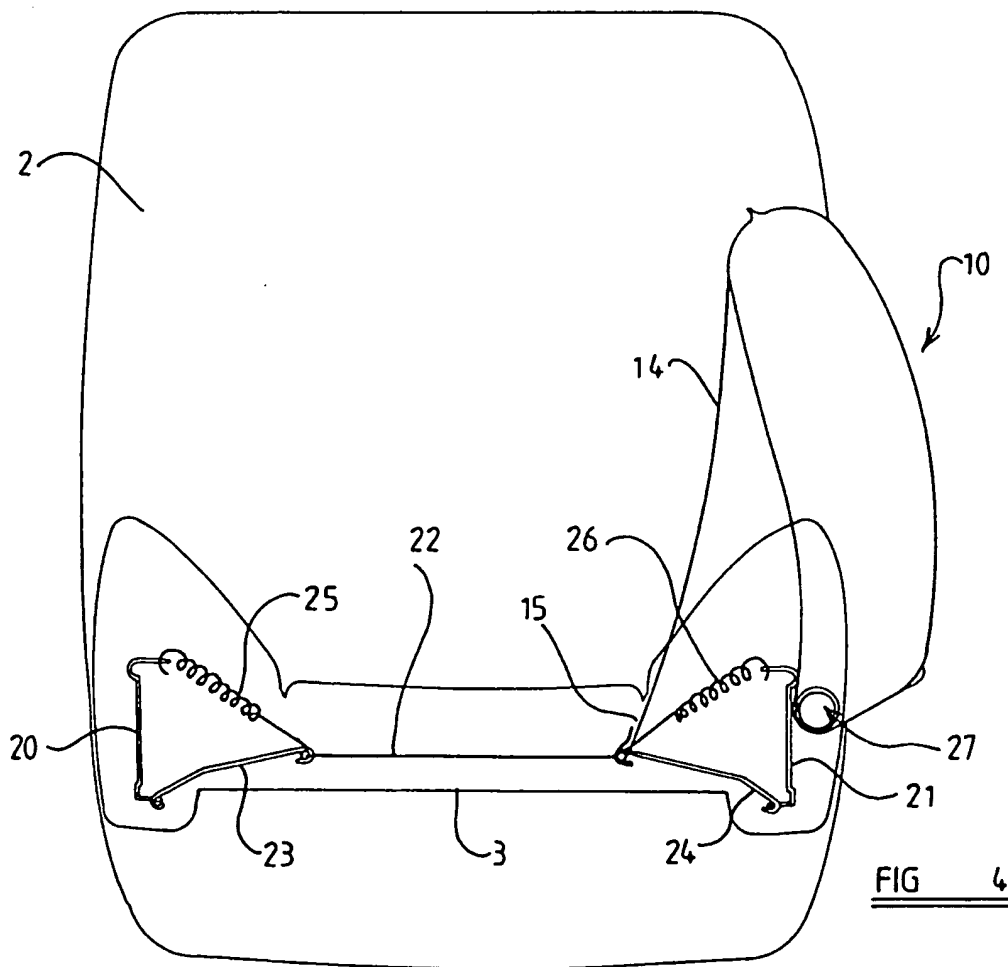
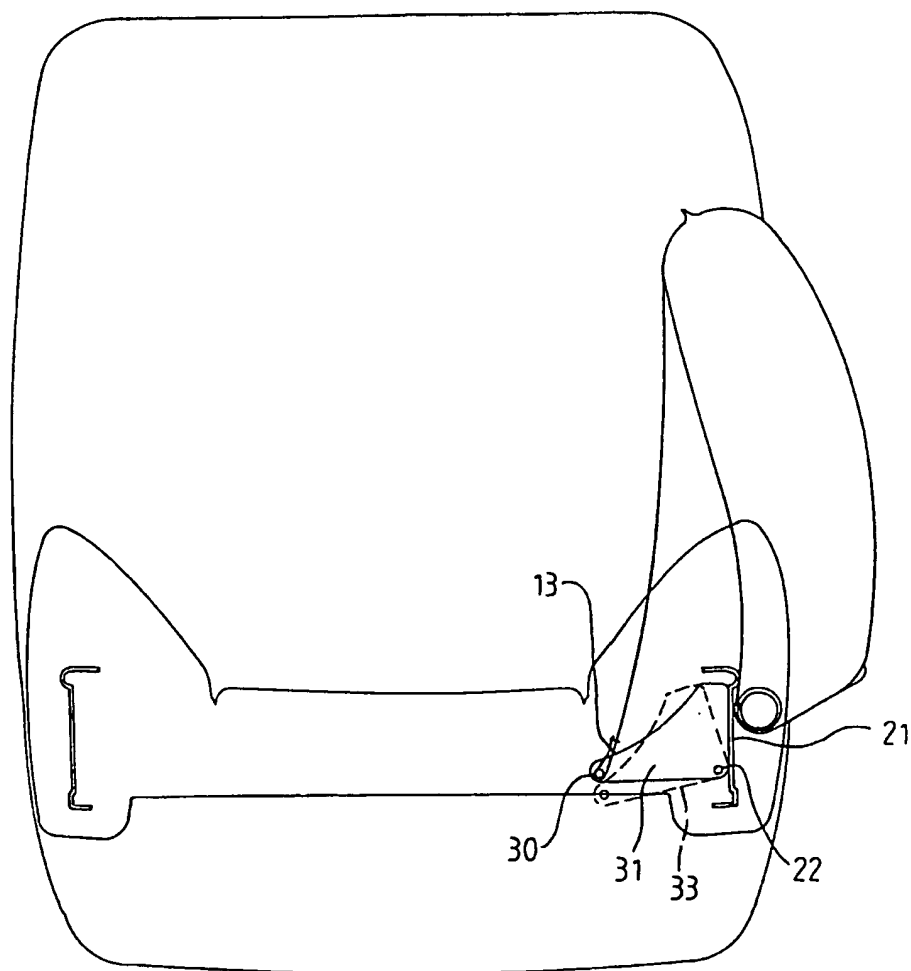


FIG 4

FIG 5

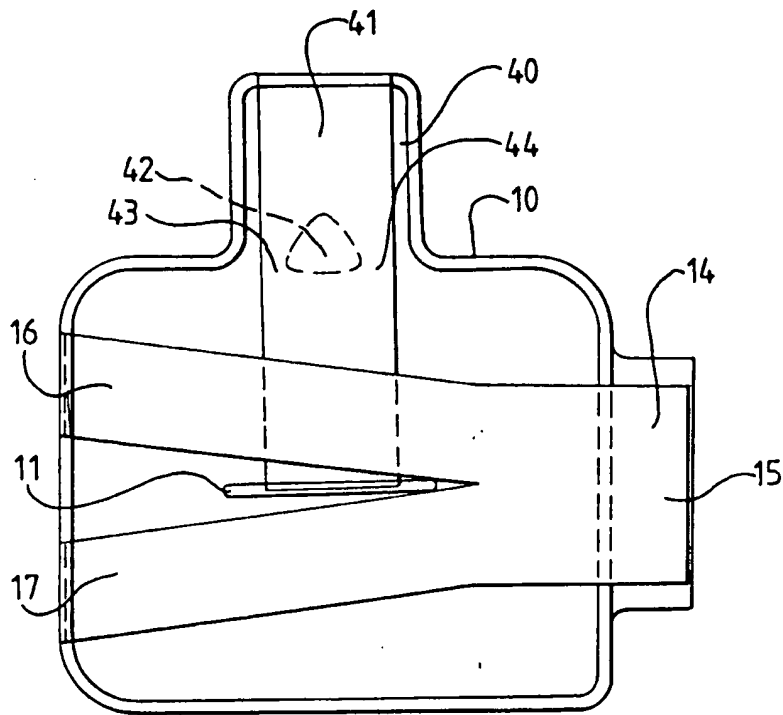


FIG 6

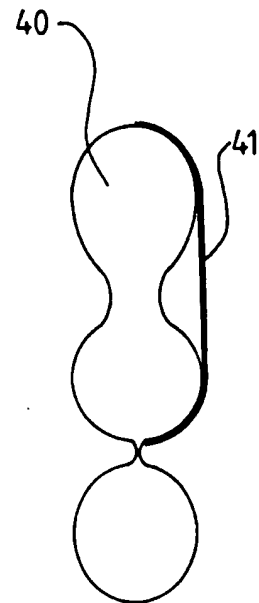


FIG 7

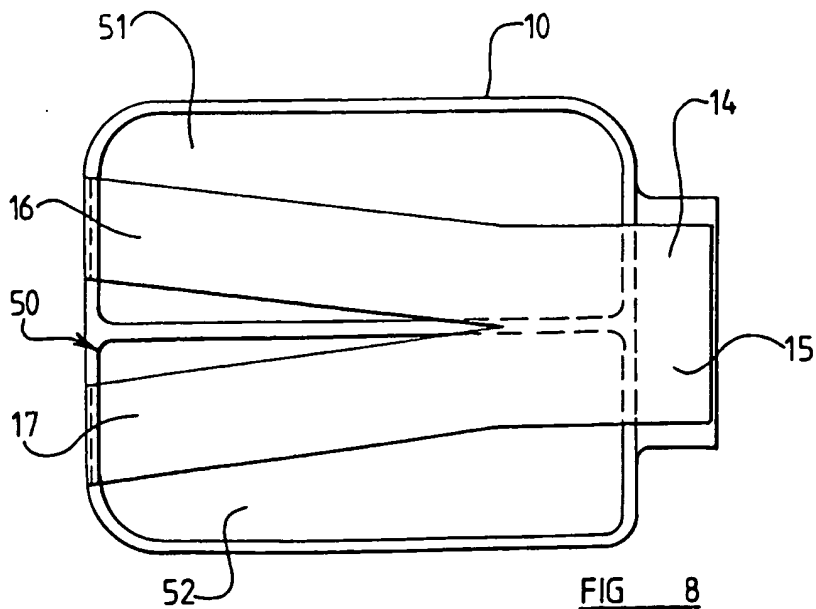


FIG 8

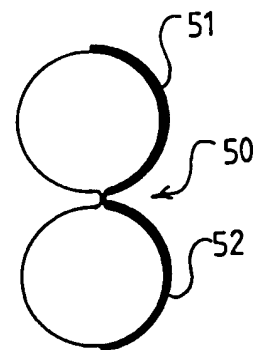


FIG 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/00004

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 21/22, B60N 2/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R, B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
| Y | US 5636862 A (CHEUNG ET AL), 10 June 1997 (10.06.97), figures 1,3, abstract -- | 1-3,8,9 |
| Y | DE 19541513 A1 (VOLKSWAGEN AG), 30 May 1996 (30.05.96), column 4, line 43 - line 52, figure 3 -- | 1-3,8,9 |
| A | DE 19635495 A1 (PARS PASSIVE RÜCKHALTESYSTEMEN GMBH), 5 March 1998 (05.03.98), figures 1,3, abstract -- | 1,8,9 |
| A | DE 19603106 A1 (MERCEDES-BENZ AKTIENGESELLSCHAFT), 31 July 1997 (31.07.97), column 3, line 11 - line 20, figure 1 -- | 1-3,8,9 |

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

17 April 2001

20 -04- 2001

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Hans Nordström/js

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/00004

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A | GB 2322338 A (AUTOLIV DEVELOPMENT AB), 26 August 1998 (26.08.98) -- | 1,2 |
| A | EP 0673807 A2 (TRW VEHICLE SAFETY SYSTEMS INC), 27 Sept 1995 (27.09.95) -- | 1,2 |
| A | US 5112079 A (HALAND ET AL), 12 May 1992 (12.05.92) -- | 2 |
| A | US 5730464 A (HILL), 24 March 1998 (24.03.98) -- ----- | 3,4 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

25/02/01

International application No.

PCT/SE 01/00004

| Patent document cited in search report | | | Publication date | Patent family member(s) | Publication date |
|---|----------|----|---------------------|----------------------------|---------------------|
| US | 5636862 | A | 10/06/97 | NONE | |
| DE | 19541513 | A1 | 30/05/96 | US 5556128 A | 17/09/96 |
| DE | 19635495 | A1 | 05/03/98 | SE 9703053 A | 03/03/98 |
| DE | 19603106 | A1 | 31/07/97 | FR 2744080 A | 01/08/97 |
| | | | | GB 2309440 A | 30/07/97 |
| | | | | GB 9701580 D | 00/00/00 |
| | | | | IT RM970028 D | 00/00/00 |
| | | | | SE 9700127 D | 00/00/00 |
| GB | 2322338 | A | 26/08/98 | AU 5331098 A | 10/02/99 |
| | | | | GB 9703516 D | 00/00/00 |
| EP | 0673807 | A2 | 27/09/95 | CA 2141726 A,C | 11/09/95 |
| | | | | JP 2747238 B | 06/05/98 |
| | | | | JP 7315156 A | 05/12/95 |
| | | | | KR 169560 B | 01/02/99 |
| | | | | US 5678852 A | 21/10/97 |
| US | 5112079 | A | 12/05/92 | DE 4018470 A,C | 20/12/90 |
| | | | | DE 4042650 C | 06/11/97 |
| | | | | FR 2648095 A,B | 14/12/90 |
| | | | | FR 2710015 A,B | 24/03/95 |
| | | | | GB 2232936 A,B | 02/01/91 |
| | | | | GB 8913563 D | 00/00/00 |
| US | 5730464 | A | 24/03/98 | WO 9706987 A | 27/02/97 |